CLAIMS

What is claimed is:

1. A quasi-resonant buck converter comprising:

a) a connection point;

b) a top switch connected to a power source and to the connection point;

c) an auxiliary switch connected to the connection point and to a return potential;

d) a resonant inductor connected to the connection point and to an output inductor;

e) a resonant capacitor connected to the return potential and to the resonant inductor, whereby the resonant inductor and resonant capacitor are connected in series across the auxiliary switch; and

f) a synchronous switch connected in parallel with the resonant capacitor.

2. The buck converter of claim 1, wherein the resonant inductor has an inductance value in the range of 1-10000 nH.

3. The buck converter of claim 1, wherein the resonant capacitor has a capacitance value in the range of 0.01-100 μF.

4. The buck converter of claim 1, wherein the quantity $\frac{3}{2}\pi\sqrt{LC}$ is in the range of 0.05 to 5 microseconds, where L is the inductance of the resonant inductor, and C is the capacitance of the resonant capacitor.

5. The buck converter of claim 1, further comprising a switch controller for controlling the synchronous switch, wherein the switch controller can phase shift the operation of the synchronous switch to control output power.

6. The buck converter of claim 1, further comprising a switch controller for controlling the gate synchronous switch, and wherein the switch controller operates the synchronous

switch so that an ON time of the synchronous switch is equal to an OFF time of the synchronous switch.

7. The buck converter of claim 1, further comprising a switch controller, and wherein the switch controller operates the synchronous switch so that an OFF time of the synchronous switch is approximately equal to $\frac{3}{2}\pi\sqrt{LC}$, where L is the inductance of the resonant inductor, and C is the capacitance of the resonant capacitor.

8. A quasi-resonant tap-buck converter comprising:

a) a connection point;

b) a top switch connected to a power source and to the connection point;

c) an auxiliary switch connected to a return potential;

d) a clamping capacitor connected to the auxiliary switch and to the connection point;

e) a resonant inductor connected to the connection point;

f) primary and secondary coupled inductors connected in series with a parallel polarity, with the primary inductor connected to the resonant inductor;

g) a resonant capacitor connected between the return potential and a midpoint of the coupled inductors; and

h) a synchronous switch connected in parallel with the resonant capacitor.

9. The buck converter of claim 8, wherein the primary coupled inductor has an inductance value in the range of 1-10000 nH.

10. The buck converter of claim 8, wherein the resonant capacitor has a capacitance value in the range of 0.01-100 μF.

11. The buck converter of claim 8, wherein the quantity $\frac{3}{2}\pi\sqrt{(L+Lk)C}$ is in the range of 0.05 to 5 microseconds, where L is the inductance of the resonant inductor, Lk is the

leakage inductance of the primary coupled inductor, and C is the capacitance of the resonant capacitor.

12. The buck converter of claim 8, further comprising a switch controller that can vary the duration of a time period A and thereby control an output power.

13. The buck converter of claim 8, further comprising a switch controller that can vary the combined duration of a time periods A and B and thereby control an output voltage.

14. The buck converter of claim 8, further comprising a switch controller that controls the circuit such that an OFF time for the synchronous switch is approximately equal to $\frac{3}{2}\pi\sqrt{(L+Lk)C}$, where L is the inductance of the resonant inductor, Lk is the leakage inductance of the primary coupled inductor, and C is the capacitance of the resonant capacitor.

15. A quasi-resonant isolated converter comprising:

a) a connection point;

b) a top switch connected to a power source and to the connection point;

c) an auxiliary switch connected to a return potential;

d) a clamping capacitor connected to the auxiliary switch and to the connection point;

e) a resonant inductor connected to the connection point;

f) a transformer with a primary winding connected between the resonant inductor and the return potential, and with a secondary winding;

g) a synchronous switch connected in series with the secondary winding; and

h) a resonant capacitor connected in parallel with the synchronous switch.

16. The buck converter of claim 15, wherein the resonant inductor has an inductance value in the range of 1-10000 nH.

17. The buck converter of claim 15, wherein the resonant capacitor has a capacitance value in the range of 0.01-100 μF.

18. The buck converter of claim 15, wherein the quantity $\frac{3}{2}\pi\frac{N_s}{N_p}\sqrt{(L+L_k)C}$ is in the range of 0.05 to 5 microseconds, where L is the inductance of the resonant inductor, Lk is the leakage inductance of the transformer, C is the capacitance of the resonant capacitor, N_s is the number of turns in the secondary winding, and N_p is the number of turns in the primary winding.

19. The buck converter of claim 15, further comprising a switch controller that can vary the duration of a time period A and thereby control the output power.

20. The buck converter of claim 15, further comprising a switch controller that can vary the combined duration of a time periods A and B and thereby control the output voltage.

21. The buck converter of claim 15, further comprising a switch controller that controls the circuit such that an OFF time for the synchronous switch is approximately equal to $\frac{3}{2}\pi\frac{N_s}{N_p}\sqrt{(L+L_k)C}$, where L is the inductance of the resonant inductor, Lk is the leakage inductance of the transformer, C is the capacitance of the resonant capacitor, N_s is the number of turns in the secondary winding, and N_p is the number of turns in the primary winding.

22. The buck converter of claim 15 wherein the transformer has a N_p/N_s turns ratio of at least 4:1.